Real-time Bidding in First and Second Price Auctions with Temporal and Targeting Constraints

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ABSTRACT

Ad placement in web-browsing and wireless mobiles is an increasingly important component of the advertisement market. The market size is over $ 100 billion and counting. The mechanism is as follows: when a user opens a webpage or mobile ap a message is sent to an exchange where multiple bidders have the possibility of placing an ad that would target the right user, eg. age, sex, location, etc. The ad that is displayed corresponds to the bidder who bids the highest while the cost is calculated according to a first or second price. Typically bidders are DSP (Demand Side Platforms) that aggregate bids on behalf of clients who wish to run a campaign for a given length of time with certain targeting criteria. The entire bidding must be done within 100ms.

I this talk I will first discuss how we can formulate this problem and obtain the "information state" for the bidding. We consider the problem optimal bidding in a real-time first and second price auctions subject to the requirement that specified collections of heterogeneous items be acquired within a given time period. The problem can be formulated as an optimal control problem. When the information state is weakly log-concave in the first price case and continuous in the second price case, the optimal problem can always be solved as a *finite* and *convex* optimization problem that meets the required 100msec constraint. Moreover, we show that there is a close connection between the first and second price case (that does not require log-concavity). Moreover, empirically on real data, there is almost no difference between optimal bids in either setting.

This work with Ryan Kinnear (Waterloo) and Peter Marbach (Toronto).

Biography: The speaker was educated at the Indian Institute of Technology, Bombay (B.Tech, 1977), Imperial College, London (MSc, DIC, 1978) and obtained his PhD in Control Theory under A. V. Balakrishnan at UCLA in 1983.

He is currently a University Research Chair Professor in the Dept. of ECE at the University of Waterloo, Ont., Canada where he has been since September 2004. Prior to this he was Professor of ECE at Purdue University, West Lafayette, USA. Since 2012 he is a D.J. Gandhi Distinguished Visiting Professor at the Indian Institute of Technology, Bombay, India. He is a Fellow of the IEEE and the Royal Statistical Society. He is a recipient of the INFOCOM 2006 Best Paper Award, the ITC-27 2015 Best Paper Award, the Performance 2015 Best Paper Award and was runner-up for the Best Paper Award at INFOCOM 1998. Since May 2019 he is an Adjunct Professor at TIFR, Mumbai.

His research interests are in stochastic modelling and analysis applied to complex networks and systems and in issues of network science.